Demo: PartsSweeper: Interactive Workbench to Casually Organize Electronic Parts and Tools

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ABSTRACT

Electronics workbenches often becomes messy, as various electronic parts and tools are used repeatedly. To solve this problem, we propose a system called "*PartsSweeper*", which cleans up both parts and tools on electronics workbenches. The PartsSweeper mainly consists of a customized XY plotter and GUI software on a tablet. We attached several magnets, servomotors, and lift mechanisms on a head of the XY plotter. As most electronic parts and tools are ferromagnetic, the system can move them along with the head while the magnet is lifted. Moreover, the system can selectively move parts and tools using two magnets of different force; while the strong magnet can move both tools and parts, the weak magnet moves only small parts.

CCS CONCEPTS

• **Human-centered computing → Interactive systems and tools**.

KEYWORDS

Workbenches, clean-up, ferromagnetic tool

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1 INTRODUCTION

Electronic parts and tools are typically placed on work desks on which electronic work, is carried out. As these tools and parts are used in different combinations, they tend to be scattered as the work progresses; careful placement of parts and tools can alleviate these problems. In practice it is often difficult to remain completely aware of the work environment as one tends to be focused on such tasks as understanding schematics and designs. (Figure 1).

Therefore, through this research, we focus on work desks in which such electronic work is performed and propose a "PartsSweeper" system that can move and arrange tools and parts on a desk in a casual manner. PartsSweeper supports workers in this task by featuring a simple drive system that moves a small number of magnets.

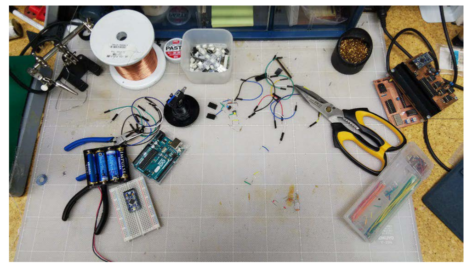

Figure 1: Example of work desk during an electronic work process.

2 RELATED WORK

Related research on desks using magnetic forces includes dePENd [5]. This is a system that aims to create new experiences and improve drawing skills, by controlling the movement of a ballpoint pen held by the user with a magnet placed on the back of a desk.

Another system that physically move objects on a desk is Cooky [3]. This system arranges multiple small robots on a desk to share tasks when cooking. The aim of Cooky is for humans and robots to work flexibly in this process. TRANSFORM [4] is an interactive piece of furniture whose shape changes. By mechanically controlling unevenness on the desk, it is possible to move objects on the desk.

A system that supports object retrieval is DrawerFinder [2]. DrawerFinder is a search support system for multiple storage boxes stored on single shelf. The contents and surrounding conditions when opening and closing the storage box are photographed automatically, and appear on a platform that is easily accessible. Limpid Desk [1] is a similar system that acquires images of lower layer documents with a desk-installed camera, projecting the processed image as if the upper-layer document were transparent with respect to the rest of the documents stacked on the desk. Currently, they are also endeavoring to improve the efficiency of document search tasks on a desk by detecting when the user has touched the upper layer document, thus triggering projection.

3 PARTSSWEEPER

3.1 Concept

PartsSweeper is a system that moves and arranges tools, parts, and other related things typically found on desks; this system focuses

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especially on work desks such as electronics workbenches. The main concepts of the system can be summarized with the following three points:

(1) Moving/Organizing tools and electronic parts
(2) Consideration of the user's work
(3) Extending existing work desks

The first point is the movement and arrangement of passive parts (resistors, capacitors, etc.) and tools (nippers, pliers, etc.) placed on the work desk for electronic work (Figure 2). We focused on the fact that many of these parts and tools are ferromagnetic. Our aim was to move parts and tools to any place by moving the magnet back and forth, as well as right and left, while adjusting the magnetic force.

The second purpose of our study was not to disturb the user's work. For example, because the layout of easy-to-use tools and parts differs for each user, an input interface for the workspace lay out of choice can be prepared. In addition, a proximity sensor can judge the seating condition of the user. It was considered that the desk could be organized when not in use, in other words while the user is away from the seat. The third point is the adoption of a simple system configuration that is easy to introduce, given the extension of the existing work desks. Specifically, a biaxial drive mechanism was mounted on the back of the desk, while a magnet was mounted on the head. Furthermore, by controlling the distance between the magnet and the desk arbitrarily, the magnetic force on tools and parts on the desk can be adjusted (Figure 3).

Figure 2: Examples of target tools and electronic parts.

3.2 System Configuration

This system consists of a control mechanism of magnetic force installed on the back of the desk and a tablet terminal to input the work-space layout (Figure 3). First, an XY plotter was adopted as a basic drive mechanism based on the concept described above. An XY plotter is a device that can move the head in two axes by computer control using two stepper motors and a timing belt (Figure 4). Generally, mechanisms such as servomotors are mounted on the head, to move a pen or similar in up and down motions.

We decided to both generate and stop the magnetic force at any place on the desk by mounting a magnet (instead of a pen), moving it up and down. Here, by moving the head while raising the magnet, it is possible to drag and move the ferromagnetic objects such as the tool or electronic parts on the desk (Figure 5); the tool or parts can be placed in the keeping location by lowering the magnet (Figure

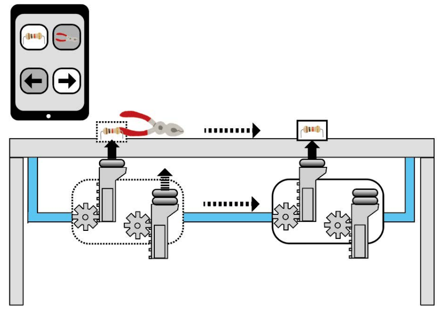

Figure 3: The concept schematic of the PartsSweeper. Based on the input from the tablet terminal, the XY plotter installed under the desk and two kinds of magnets are controlled to selectively move / organize parts and tools.

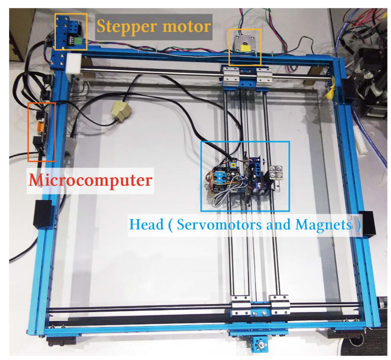

Figure 4: The XY plotter that was adopted as the basic drive mechanism.

5). Because the influence of the magnetic force may remain on the desk if the magnet is not sufficiently separated from the desk, we decided to create a mechanism to convert the rotational motion of the servomotor into an elevation motion. In addition, these motors were controlled by one microcomputer.

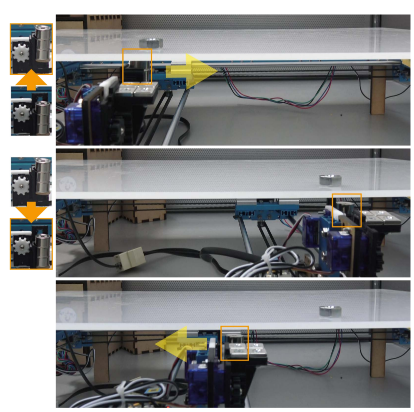

Figure 5: It is possible to move the bolt on the desk by moving the head while raising the magnet. By lowering the magnet, the bolt cannot move from where it was placed.

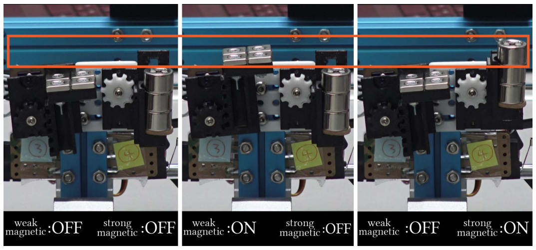

Figure 6: Two types of heads with different magnetic forces.

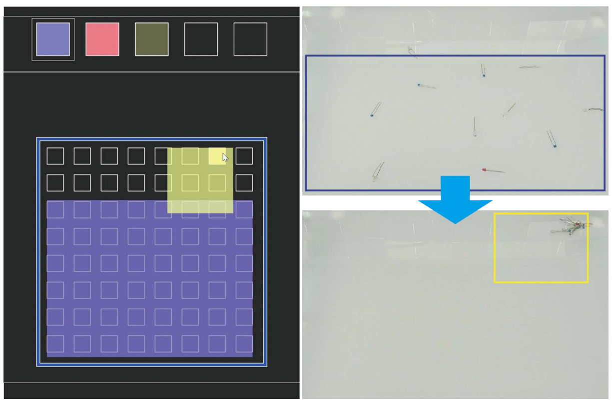

Figure 7: Prototype of an input interface for organizing tools and electronic components by tablet terminals.

Two types of heads with different magnetic forces were also mounted (Figure 6). Because the weights of tools such as pliers and smaller electronic parts such as resistors are different; smaller objects are first moved by applying a weak magnetic force and larger objects are than moved by applying a stronger magnetic force. The possibility that parts and tools can be moved and organized individually also exists.

PartsSweeper provides an input interface for organizing tools and electronic components by tablet terminals. For example, (1) first, the operation of the system can be set by inputting "part space" or "tool space" from the tablet. (2) Next, it is possible to control the movement the parts with a weak magnetic force to the designated "part or tool space" (Figure 7).

Figure 8 shows examples of objects moved by the PartsSweeper.

4 CONCLUSIONS

In this research, we focused on work desks such as those used for electronic work, by proposing and prototyping a "PartsSweeper" system that can move and arrange both tools and parts on a desk, in a casual manner. It consists mainly of an XY plotter installed on the back of a desk, two types of magnets and a lift mechanism on its head, and a tablet terminal for entering work-space parameters. At this point, we have confirmed our work up to the point where tools or parts can be both moved and placed individually using a magnetic force. In the future, we would like to verify the effectiveness of the system through operation in an actual electronic work environment, and thus solve any remaining problems.

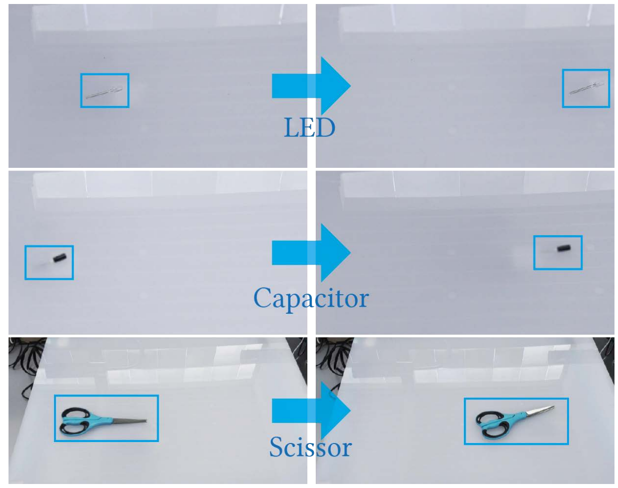

Figure 8: Examples of objects moved by PartsSweeper.

ACKNOWLEDGMENTS

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